RFID – Part I Of 2

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Well, I guess it's time to talk about the elephant in the room. After all, this is the Technology column, and Radio Frequency IDentification has been on the horizon ever since Wal-Mart announced last year that they were planning to require having their largest vendors use it. As January approaches it looms ever larger, so it seems a good time to review RFID—what it is, how it works, what it means to manufacturers and so on.

The fundamental concepts of RFID are not new; in fact, the technology has been around since the end of World War II. In essence, the idea is simple—apply a device to an object that can emit radio signals that can be picked up by a receiver. This device (the "tag") is encoded with a numeric representation for purposes of identification, so once read the reader knows the number of the item. Think of the RFID tag as a bar code label that does not require a laser to read it, but rather a radio receiver.

There are numerous technical issues surrounding this seemingly simple explanation, but we'll get into that later. Let me first start with the basics.

There are actually two general types of RFID tags. So-called "Active" tags contain a battery that powers the radio transmitter mentioned earlier. These tags are used for large items such as shipping containers, railroad cars or vehicles (the US Army has experimented with electronically tagging tanks). Since there is a battery supplying power to the transmitter, tags of this nature can be detected from a fairly large distance – 100 yards or more in some cases. The readers for these tags are much like your table radio, tuned to the proper frequency and picking up the signal sent by the tag. Of course, a battery implies that there is a shelf life to these tags; the battery does eventually die. Further, battery powered active tags are somewhat costly, up to $5 each or more.

The consumer goods industries are not interested in active tag technology. Rather, Wal-Mart, Target and other retailers who have been experimenting with the technology have been using so-called "passive" tags. Passive type RFID tags differ in that there is no battery in them. These tags acquire their power to transmit from the very radio waves they receive from the interrogator/reader unit. That is, where the reader for active tags is a relatively simple radio receiver, for passive type tags the reader is both a transmitter and a receiver. These units constantly send out a relatively weak radio signal which is detected by the passive tags. The circuitry within a passive tag actually uses some of the power of the radio signal to respond to the signal with its own transmission. Part of the circuit is a microelectronic chip that in encoded with the appropriate number; it is this number that is sent in the response signal. Since they do not contain their own power source and can only respond with a relatively weak signal, passive tags have a smaller working radius than active tags – the longer range tags can be read from up to about ten feet away.

I alluded to a certain similarity to bar code labels above, and in one sense they are quite similar other than the fact that RFID does not require so-called "line-of-sight" access for reading. That is, while reading a bar code label requires the laser reader be able to directly "view" the tag, with RFID a reader could read the tags on cartons in the middle of a pallet, even if those tags are not visible to the worker holding the reader. As you might imagine, this can dramatically change the way inventory is handled in the warehouse. In theory, the entire contents of a pallet could be read into the system in one pass, even while the forklift moving that pallet is moving through the reader "doorway". Compare this to having workers break down that pallet to individually scan carton labels with a laser gun, and you can start to understand why the retail community is looking forward to some real gains in workflow efficiency.

The number that is encoded on an RFID tag is a so-called Electronic Product Code (ePC), as defined by EPCGlobal, the analogue to the UCC that controls the dissemination of UPC codes in the US. ePC codes are based on the GTIN (Global Trade Identification Number) codes, which themselves are a superset of the EAN (European Article Number). What does all that mean?

Basically, the UPC code used in North America is a numbering system that was devised to ensure that every product (Stock Keeping Unit) has a unique numeric identification. This is what is encoded on the bar code of the label on the item or the carton. There are 12 digits in a UPC code, but the very last digit is a check digit to ensure proper reads and is not part of the assigned coding system. The first 6 digits specify the manufacturer, and the next 5 digits are assigned by the manufacturer to designate a particular item. The idea is that, once a specific UPC number is registered with the UCC, anyone in the country who sees a tag 123456-54321 can find out the details of the product to which the tag is attached.

In Europe, the EAN system was created for the same reason, though it uses one additional digit on the product code side (meaning that 10 times as many products can be numbered before one runs out).

GTIN started out as a way of converging these two systems, so that a single GTIN code could be used worldwide. GTIN definitions went on to allow for some variations; there are 8, 12, 13 and 14 digit EAN coding definitions. With the advent of RFID, it was decided to expanded the GTIN definitions to make the ePC.

Next month, I will describe ePC codes in more detail as well as get into other aspects you should know about RFID.

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